

PETITION

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Your Petitioners, Douglas H. Anders and Ronald D. Walton, citizens of the United States of America and residents of the States of Nebraska, whose residence and mailing address for Douglas H. Anders is 520 Lakehurst, Waterloo, Nebraska 68069 and for Ronald D. Walton is 5055 South 161st Circle, Omaha, Nebraska 68135, pray that Letters Patent Protection be granted to them for a

FREE WEIGHT ASSISTANCE AND TRAINING DEVICE

as set forth in the following specification:

Cross-Reference to Related Application

This application claims priority to the filing date of related patent application serial No. 60/463,221 filed April 16, 2004.

Background of the Invention

1. Technical Field

The present invention relates to weight training devices and, more particularly, to a free weight assistance and training device which includes a base, an upright weight support structure extending over and above the user of the device, a free weight support bar, a computer-controlled weight tensioning device mounted adjacent the upright weight support structure and a cable and pulley system extending over the upright weight support structure interconnecting the free weight bar and the weight tensioning device such that tensioning force applied by the weight tensioning device to the free weight support bar via the cable and pulley system is operative to decrease the amount of downwards force

1 exerted by the free weight support bar, the device utilizing
2 selected training methods through the computer-controlled weight
3 tensioning device to produce desired workout results.

5 **2. Description of the Prior Art**

6 Even with the variety of exercise and muscle-building
7 equipment and activities available, free weight lifting continues
8 to be the workout method of choice for many athletes. Free weight
9 lifting allows unrestrained motion during lifting, closely
10 approximating application of human strength in many recreation and
11 sporting activities. Also, the selection of weights utilized in
12 free-weight lifting is highly repeatable as compared to machines
13 employing levers, cams, and resistance elements such as springs and
14 hydraulic or pneumatic cylinders. Furthermore, free weights
15 provide uniform resistance unaffected by wear of mechanical parts
16 and other components.

17 One disadvantage limiting use of free weights is the need for
18 one or more spotters, especially in strength-building regimens that
19 are intended to test the strength and endurance limits of the user.
20 These regimens are most effective when the user continues
21 repetitions until he or she is unable to lift the free weight bar.
22 This is a safety concern if spotters are not immediately available
23 since the user may be unable to safely lift the weight to a support
24 device. Even when spotters are available, they may not recognize
25 an unsafe condition or their response may not be quick enough to
26 prevent injury.

27 Another disadvantage of free weights is that the amount of
28 weight to be lifted is unchangeable during the lift, as once the

1 weights are placed on the weight bar, weight cannot be added or
2 subtracted during the lift. This means that if the weight user
3 cannot lift the weight during the repetitions, he or she has to
4 stop and not receive the full benefit of the workout. Although
5 spotters can be of some assistance in providing partial assistance
6 in the lifting of the free weight, the disadvantage of this
7 assistance is that the spotter may assist too much or too little,
8 and again the efficiency of the workout is compromised. There is
9 therefore a need for a device which will provide the correct level
10 of assistance for the free weight user yet will not interfere with
11 the lifting process until needed.

12 Self-spotting machines, disclosed by others, have addressed
13 eliminating the need for one or more spotters. For example, U.S.
14 Patent No. 4,949,959 discloses a barbell assist device utilizing a
15 motor-driven yoke assembly. The yoke assembly provides cables that
16 extend around sheaves and downwardly from each end of the housing
17 to support a barbell over a weight bench. U.S. Patent No.
18 5,048,826 discloses a device utilizing a winch assembly to retract
19 and release cables supporting the barbell. U.S. Patent No.
20 5,310,394 discloses a spotter system for weightlifters employing a
21 pneumatic piston and cylinder. The cylinder provides lift
22 assistance to the barbell through a lever arm, chain drive, pulley
23 and cables.

24 However, none of the aforementioned devices provide
25 independent support of both ends of the free weight bar. In fact,
26 the assistance provided by these inventions does not accomplish the
27 intended purpose of assisting with the lift without interfering
28 with the lift, and therefore are inadequate for the purposes of

1 this invention.

2 Many other devices have been proposed in the prior art which
3 are intended to fulfill spotting and assisting purposes, each of
4 which include inherent disadvantages and do not fully address the
5 needs of the free weight user, particularly in connection with
6 providing graduated assistance for lifting in connection with a
7 specified exercise program. It is these needs that the present
8 invention attempts to address and solve.

9 Therefore, an object of the present invention is to provide an
10 improved free weight assistance and training device.

11 Another object of the present invention is to provide a free
12 weight assistance and training device which includes a generally
13 upright weight support structure, a free weight support bar and a
14 computer-controlled weight tensioning device connected to the free
15 weight support bar by at least two cables such that when the cables
16 are tensioned, additional lifting power is applied to the free
17 weight support bar to provide assistance to the user of the free
18 weight assistance and training device during the lifting exercise.

19 Another object of the present invention is to provide a free
20 weight assistance and training device which is designed to assist
21 the user only to the extent that he or she needs in order to
22 complete the exercise set and keep the free weight support bar
23 moving during the exercise set.

24 Another object of the present invention is to provide a free
25 weight assistance and training device which includes a computerized
26 exercise tracking mechanism which tracks the user's weight lifting
27 pattern to identify areas of instability or weakness so that the
28 user may focus on those areas during subsequent lifting sessions.

1 Another object of the present invention is to provide a free
2 weight assistance and training device which will perform all the
3 duties of a spotter thus removing the need for a human spotter to
4 assist the user of the present invention.

5 Finally, an object of the present invention is to provide a
6 free weight assistance and training device which is sturdy and
7 durable in construction and is safe and efficient in use.

Summary of the Invention

The present invention provides a free weight assistance and training device which includes a base and a generally upright weight support structure mounted on and extending upwards from and over the base. A free weight support bar is connected to a computer-controlled weight tensioning device which is mounted on the base generally adjacent the upright weight support structure, the connection between the free weight support bar and the computer-controlled weight tensioning device consisting of at least two cables movably mounted on the upright weight support structure and extending between and connecting the free weight support bar and the computer-controlled weight tensioning device. The computer-controlled weight tensioning device, the at least two cables and the free weight support bar operatively cooperate with each other such that tensioning force applied by the computer-controlled weight tensioning device via the at least two cables to the free weight support bar controllably decreases the amount of downwards force exerted by the free weight support bar due to the weight of the free weight support bar and weights thereon whereby a user of the free weight assistance and training device may receive assistance during lifting of the free weight support bar via the computer-controlled weight tensioning device.

The present invention as thus described provides a substantial improvement over those devices found in the prior art. For example, because of the amount of assistance provided is variable depending on the speed of the lift and the weight being lifted, the user of the present invention receives maximum benefit from the exercise while minimizing the risk of injury due to improper

1 spotting and/or assistance being provided. Also, because the
2 computer system of the present invention tracks substantially all
3 of the movements of the free weight bar both vertically and
4 horizontally during the lift, the user of the present invention may
5 quickly and easily determine whether his or her lifting style is
6 the most efficient possible or even if the lifting style may
7 eventually lead to injury. Furthermore, the design of the present
8 invention means that the invention may be used for many different
9 types of lifting exercises, and thus is not only restricted to
10 bench work but also may be used for squats and other such standing
11 exercises which cannot be done with other inventions found in the
12 prior art. Finally, because of the numerous safety features of the
13 present invention, the opportunity for injury is greatly reduced
14 and the user of the present invention may thus safely and
15 efficiently use free weights for his or her exercise program. It
16 is thus clear that the present invention provides a substantial
17 improvement over those devices found in the prior art.

1 **Brief Description of the Drawings**

2 Figure 1 is a perspective view of the free weight assistance
3 and training device of the present invention;

4 Figure 2 is a side elevational view of the present invention;

5 Figure 3 is a detail top plan view of the specific features of
6 the weight tensioning device of the present invention;

7 Figures 4 is a top plan view of the cable tensioning device of
8 the present invention showing the operative elements of the device;

9 Figure 5 is a top plan view of the winching device of the
10 present invention;

11 Figure 6 is a detail perspective view of the free weight
12 support bar of the present invention; and

13 Figure 7 is a side elevational view of the bar position
14 detection device of the present invention showing the operative
15 elements of the device.

Description of the Preferred Embodiment

The free weight assistance and training device **10** of the present invention is shown best in Figures **1-3** as including three primary units, a generally upright weight support structure **12**, a free weight support bar and connected cable system **70** and a computer-controlled weight tensioning system **100** which is operative to tension the cable system to decrease the amount of force which must be applied by a user of the invention to lift the free weight support bar. In the preferred embodiment, weight support structure **12** would include a pair of base feet **14a** and **14b** having leveling pads **15** mounted on the undersides thereof, and further on each of which is mounted an upright main weight support post **16a** and **16b** which each extend upward from the base feet **14a** and **14b** approximately sixty to one hundred twenty inches (60" to 120") depending on the intended use of the unit (i.e. bench press, snatch, curls, etc.). Furthermore, it is preferred that the base feet **14a** and **14b**, main weight support posts **16a** and **16b** and other elements of the weight support structure **12** of the present invention which cooperate to support the free weights will be constructed of sturdy steel box beams welded or bolted to one another to ensure that the weights are safely and sturdily supported at all times to prevent injury to the user of the invention. Of course, any appropriate construction material may be used with the present invention so long as the safety of the user is maintained.

A cross brace beam **18** extends between and connects the main weight support posts **16a** and **16b** adjacent the upper sections thereof for securing the main weight support posts **16a** and **16b** in

1 spaced apart, generally parallel relation. Mounted atop each of
2 the main weight support posts **16a** and **16b** is a weight support beam
3 **20a** and **20b** each of which extend forwardly generally parallel with
4 each other approximately ten to thirty inches (10" to 30") from the
5 main weight support posts **16a** and **16b**, as shown best in Figures **1**
6 and **2**. To increase the structural stability of the weight support
7 structure **12**, it is further preferred that a number of generally
8 triangular gussets **22** be mounted on the weight support structure **12**
9 adjacent the connections between the main weight support posts **16a**
10 and **16b** and the base feet **14a** and **14b** and the weight support beams
11 **20a** and **20b**. The gussets **22** stabilize the connections and act to
12 prevent collapse of the weight support structure **12** even if a large
13 amount of weight is being supported by the device **10** of the present
14 invention.

15 The free weight support bar and connected cable system **70** of
16 the present invention is best shown in Figures **1** and **2** as including
17 a free weight support bar **72** on which are mounted left and right
18 weight stops **74a** and **74b** which cooperate to position weight plates
19 (not shown) correctly on the free weight support bar **72**. Two
20 weight support cables **80a** and **80b** are each respectively connected
21 to one of the left and right weight stops **74a** and **74b** and extend
22 upwards therefrom, the weight support cables **80a** and **80b** being
23 constructed of wire or Kevlar cable having a high tensile strength
24 to ensure safe operation of the present invention. The weight
25 support cables **80a** and **80b** extend into the weight support beams **20a**
26 and **20b** and as the weight support cables **80a** and **80b** are supported
27 within the weight support beams **20a** and **20b** in substantially the
28 same manner, the following description of the support features of

1 weight support beam **20a** should be understood to apply equally to
2 the support features of weight support beam **20b**.

3 Weight support cable **80a** extends into the hollow interior of
4 weight support beam **20a** where it passes over and engages forward
5 pulley **82** rotatably mounted within the forward section of weight
6 support beam **20a** and oriented generally parallel with the base foot
7 **14a**. As the weight support cable **80a** extends rearwardly through
8 the weight support beam **20a**, it passes over and engages rearward
9 pulley **84** rotatably mounted within the rearward section of weight
10 support beam **20a** and oriented generally parallel with forward
11 pulley **82**. The weight support cable **80a** then extends downwards to
12 the computer-controlled weight tensioning system **100** which tensions
13 the weight support cable **80a** according to the programming and
14 weight training regimen selected by the user of the present
15 invention. Of course, the forward and rearward pulleys **82** and **84**
16 may be modified or replaced by slides or other such cable guides so
17 long as the weight support cable **80a** is guided through the weight
18 support beam **20a**.

19 The computer-controlled weight tensioning system **100** is shown
20 best in Figures **2**, **3** and **4** as including a pair of threaded cable
21 reels **102a** and **102b** which are mounted on rotatably mounted reel
22 shafts **104a** and **104b** which permit the cable reels to rotate to
23 extend or retract the weight support cables **80a** and **80b** which are
24 wound thereon. The threading on the cable reel surface of each of
25 the cable reels **102a** and **102b** ensure accurate take-up of the cables
26 **80a** and **80b**, i.e. each rotation of the cable reels **102a** and **102b**
27 takes up an identical length of cable. The drive shafts **108a** and
28 **108b** of a pair of drive motors **106a** and **106b** are operatively

1 connected to the cable reels **102a** and **102b** to rotate them in
2 response to rotation of the drive shafts **108a** and **108b**. Sensor
3 units **110a** and **110b** are mounted adjacent the reel shafts **104a** and
4 **104b**, the sensor units **110a** and **110b** operative to detect the
5 rotational speed, direction and amount of rotation of the reel
6 shafts **104a** and **104b** and transfer that information to a computer-
7 based control mechanism **112**. In the preferred embodiment, the
8 sensor units **110a** and **110b** are "encoders", that is, they are
9 optical disks that have alternating light and dark radial sections
10 which count the number and speed of the pulsations and forwards
11 that information to the computer-based control mechanism **112**. In
12 this manner the speed, direction and number of rotations of each of
13 the reel shafts **104a** and **104b** is fed to the computer-based control
14 mechanism **112** for further processing. The encoders establish the
15 "windows" as described below and the speed for the lift and fall of
16 the free weight support bar **72**.

17 While the drive shafts **108a** and **108b** and reel shafts **104a** and
18 **104b** cooperate to control the lift assistance provided to the user
19 of the present invention, in the event the need arises to change
20 the vertical positions of the bar **72**. Therefore, the lifting of
21 the entire free weight support bar **72** is preferably performed by a
22 separate lift motor **120** which engages the reel shafts **104a** and **104b**
23 through the locking of clutches **116a** and **116b**. This enables the
24 lift motor **120** to rotate the reel shafts **104a** and **104b** and the
25 cable reels **102a** and **102b** to wind the cables **80a** and **80b** to raise
26 or lower the free weight support bar **72** by overpowering the drive
27 motors **106a** and **106b**. Finally, the release of cable from cable
28 reels **102a** and **102b** is controlled by a pair of reel brakes **109a** and

1 **109b** which prevent rotation of the reel shafts **104a** and **104b** upon
2 receiving a signal from the computer-based control mechanism **112**.

3 The computer-based control mechanism **112** is operatively
4 connected to the drive motors **106a** and **106b** to command the drive
5 motors **106a** and **106b** to rotate drive shafts **108a** and **108b** to
6 provide powered assistance to the reels **102a** and **102b** in lifting
7 the free weight support bar **72** via the weight support cables **80a**
8 and **80b**. In the preferred embodiment, the computer-based control
9 mechanism **112** would be a standard computing device incorporating a
10 hard drive, motherboard with processor, memory, and other necessary
11 elements for performing computing operations. For inputting
12 information into the computer-based control mechanism **112**, a touch-
13 activated computer screen **114** is mounted on and adjustable on
14 support member **116** which in turn is mounted on and extends
15 downwards from cross brace beam **18**, as shown best in Figures **1** and
16 **2**, although the exact location of the computer screen **114** or, for
17 that matter, any appropriate input device, would be determined
18 according to user preferences and may be in any location on or
19 adjacent the free weight assistance and training device **10**. In the
20 preferred embodiment, the touch-activated computer screen **114**
21 permits the user of the present invention to enter specific workout
22 data, including such information as the user's name, and
23 identifying code number, and other information to identify the user
24 of the present invention. The user would then be able to enter
25 information connected directly with the exercise routine which is
26 to be performed, including such details as high and low point
27 ranges of the lift being performed, the lift off weight to be
28 removed from the weight being lifted to enable proper motion during

1 the lift, a window, which would be the distance the free weight
2 support bar **72** can travel downwards before assistance is provided
3 by the weight tensioning system **100** and the assist speed, which is
4 the determination of the amount of time the user of the invention
5 will receive before assistance is applied while doing the specified
6 lift. Of course, other forms of data input devices such as
7 keyboards and disk drives may be used to input information, and
8 many other types of additional information may be entered using the
9 touch-activated computer screen **114** depending on the specific
10 programming features of the computer-based control mechanism **112**,
11 all of which may be used by the free weight assistance and training
12 device **10** of the present invention to provide enhanced workouts.
13 Finally, a digital readout **140** is mounted on the cross brace beam
14 **18** or another readily viewable location, the digital readout **140**
15 connected to the computer-based control mechanism **112** and operative
16 to display the lift assistance in pounds or the like relating to
17 the lift being performed.

18 Prior to beginning discussion of the operation and use of the
19 present invention, the remaining physical features shown in Figures
20 **1-3** will be described herein. In the preferred embodiment, the
21 computer-controlled weight tensioning system **100** would further
22 include a housing **120** which completely covers and encloses each of
23 the features described in connection with the computer-controlled
24 weight tensioning system **100** save the touch-activated computer
25 screen **114**. In this manner, accidental touching of the components
26 by the user is prevented, thus increasing the safety of the device.
27 Additional safety features which are incorporated into the present
28 invention include a pair of safety bars **24a** and **24b** which extend

1 generally horizontally forwards from main weight support posts **16a**
2 and **16b** with the forward ends of the safety bars **24a** and **24b** being
3 supported by a pair of generally upright weight support bar posts
4 **26a** and **26b** each mounted on and extending upwards from one of the
5 base feet **14a** and **14b**. In operation, safety bars **24a** and **24b** are
6 positioned below the lower range limit of movement of the free
7 weight support bar **72** to prevent the free weight support bar **72**
8 from injuring the lifter in the event of emergency release of the
9 free weight support bar **72**. Finally, a pair of weight support
10 brackets **28a** and **28b** are adjustably mounted on the main weight
11 support posts **16a** and **16b**. The main weight support posts **16a** and
12 **16b** would preferably include a plurality of vertically spaced
13 mounting holes **30** formed in the forward wall of each of the main
14 weight support posts **16a** and **16b**, the holes **30** operative to receive
15 and secure the weight support brackets **28a** and **28b** in a specified
16 vertical position along main weight support posts **16a** and **16b**. In
17 this manner, a user of the invention may move the free weight
18 support bar **72** rearwardly on the machine until the free weight
19 support bar is positioned over the weight support brackets **28a** and
20 **28b** and thus release of the free weight support bar **72** downwards
21 removably positions the free weight support bar **72** on the weight
22 support brackets **28a** and **28b**. In this manner, various types of
23 exercises may be performed by the user of the present invention,
24 such as overhead presses, curls, and other such exercises in which
25 the free weight support bar **72** would not be returned to its
26 lowermost resting position as defined by the weight support bars
27 **24a** and **24b**. Finally, a pair of take-up reels **87a** and **87b** are
28 mounted within the housing **120** and are connected to the handle

1 sensor cables **86a** and **86b** to alternatively take up or release cable
2 during the exercise being performed to ensure that slack does not
3 develop in the handle sensor cables **86a** and **86b** thus preventing
4 interference with the exercise.

5 One of the most important safety features of the present
6 invention involves the handle grip sensing device **200** which is
7 mounted on the free weight support bar **72** and shown best in Figures
8 **1** and **6**. In the preferred embodiment, the handle grip sensing
9 device **200** would include a pair of light-sensitive sensing units
10 **202a** and **202b** mounted on the free weight support bar **72**, one
11 adjacent each of the left and right weight stops **74a** and **74b** and
12 each facing inwards towards the center of free weight support bar
13 **72**. Slidably mounted on the free weight support bar **72** adjacent
14 the center thereof are a pair of reflective disks **204a** and **204b**
15 which may be moved towards or away from the sensing units **202a** and
16 **202b** depending on the exercise being performed and the hand
17 position on the free weight support bar **72**. In the preferred
18 embodiment, the sensing units **202a** and **202b** would send infrared
19 beams of light (shown as the back-and-forth arrows on Figure **6**)
20 outwards therefrom extending generally parallel with the free
21 weight support bar **72**. When the beams encounter the reflective
22 disks **204a** and **204b**, they are reflected back to the sensing units
23 **202a** and **202b** signifying that no one is using the free weight
24 assistance and training device **10** of the present invention. When
25 a user places his or her hands on the free weight support bar **72** in
26 preparation to do an exercise, however, the light beams are
27 interrupted and the sensing units **202a** and **202b** send this
28 information to the computer-based control mechanism **112** via handle

1 sensor cables **86a** and **86b**. During the exercise, the computer-based
2 control mechanism **112** checks to make sure that the free weight
3 support bar **72** is still being gripped by the user of the invention,
4 and if at any time the sensing units **202a** and **202b** recognize that
5 the hands of the user have left the free weight support bar **72**, the
6 computer-based control mechanism **112** locks the reel brakes **109a** and
7 **109b** and prevents the free weight support bar **72** from either
8 raising or lowering until the situation is rectified.

9 The following description of one type of exercise being
10 performed with the free weight assistance and training device **10** of
11 the present invention should be understood to apply generally to
12 other types of exercise motions to be performed with the invention,
13 but is believed that the following description is illustrative of
14 the use of the present invention. For the standard bench press
15 exercise, a user of the invention would position him or herself in
16 a generally horizontal position underneath the free weight support
17 bar **72** on a bench or the like. Of course, prior to positioning him
18 or herself beneath the free weight support bar **72**, the user of the
19 present invention would enter his or her personal information into
20 the computer-based control mechanism **112** of the touch-activated
21 computer screen **114**. As was stated previously, this information
22 would define the parameters of the exercise to be performed and
23 would include vital information such as the weight being used,
24 assistance to be provided, and range of motion desired,
25 specifically directed to such critical details as the windows of
26 movement for the exercise and the liftoff position for the
27 exercise. Once the user of the present invention is positioned
28 beneath the free weight support bar **72**, the reflective disks **204a**

1 and **204b** are slid into proper position and the desired amount of
2 weight is mounted onto the ends of free weight support bar **72**. The
3 exercise regimen now can begin. As the user lifts the free weight
4 support bar upwards from weight support bars **28a** and **28b**, the
5 computer-based control mechanism **112** provides a degree of
6 assistance referred to as the liftoff assistance, in which a
7 percentage of the overall weight of the free weight support bar **72**
8 and weights mounted thereon is taken up by a rotation of the drive
9 shafts **108a** and **108b** of drive motors **106a** and **106b** which drive
10 cable reels **102a** and **102b** to apply tension to weight support cables
11 **80a** and **80b** thus removing a portion of the weight on the free
12 weight support bar **72** therefrom. As the lift continues, the
13 computer-based control mechanism **112** signals the drive motors **106a**
14 and **106b** to continue reeling in the weight support cables **80a** and
15 **80b** to prevent slack forming in the cables until the upper limit is
16 reached. The lifter lowers the bar to the lower limit and then it
17 is the user of the invention who is providing the upwards force to
18 raise the free weight support bar **72** and weights mounted thereon
19 until such time as the computer-based control mechanism **112** detects
20 that motion of the free weight support bar **72** has slowed or stopped
21 after the free weight support bar **72** has left its lower limit. In
22 the preferred embodiment, a small time delay would be instituted
23 between the time the computer-based control mechanism **112** detects
24 stopping of the raising of the free weight support bar **72** by the
25 user and the instigation of powered assistance by the computer-
26 based control mechanism **112** via the cable reels **102a** and **102b** in
27 order to give the user of the present invention every opportunity
28 to maximize the intensity of the workout.

1 At some point, however, the user of the present invention will
2 be unable to lift the entire amount of the weight of the free
3 weight support bar **72** and weights mounted thereon. The free weight
4 assistance and training device **10** detects this by sensing the
5 cessation of motion of the free weight support bar **72**, as detected
6 by the sensor units **110a** and **110b**. At this time that the computer-
7 based control mechanism **112** increases the tension of the drive
8 motors **106a** and **106b** to rotate drive shafts **108a** and **108b** to rotate
9 the cable reels **102a** and **102b** to tension the weight support cables
10 **80a** and **80b** thus removing a portion of the weight of the free
11 weight support bar **72** and weights mounted thereon in incremental
12 stages until the user is able to continue the lift. The user of
13 the present invention is thus able to continue his or her lifting
14 motion and reach maximum intensity for the workout without being
15 concerned about his or her ability to simply raise or lower the
16 free weight support bar **72**. This reactive ability of the computer-
17 based control mechanism **112** to assist the user of the present
18 invention by lifting a variable portion of the total weight being
19 lifted is a unique and valuable attribute of the present invention.
20 In fact, it has been found that, through the use of the present
21 invention, workout routines are greatly enhanced and the lifting of
22 progressively heavier weights may be incorporated into the workout
23 routine without the risk of accidental release of the free weight
24 support bar **72** due to muscle failure. Furthermore, it can easily
25 be seen that the present invention may be used for a large variety
26 of weight lifting routines by merely modifying the parameters of
27 use, including the weight being used, assistance supplied, range of
28 motion, and time delay between muscle failure and assistance being

1 provided. Additional details of the preferred operation of the
2 present invention may be found in the attached Appendix "A", in
3 which a listing of the preferred general operational and computer
4 procedures for the present invention are disclosed. Of course,
5 Appendix "A" should be seen as providing examples of the use of the
6 present invention and is not limiting in any manner as to the
7 intended functionality and uses of the present invention.

8 Additional features of the present invention are shown in
9 Figures **1, 2, 3** and **7** and include a balance pad **400** placed on the
10 floor surface between base feet **14a** and **14b**. The balance pad **400**
11 is connected in information transmission connection with the
12 computer-based control mechanism **112** to track weight distribution
13 of the lifter during the lift for increasing efficiency of the
14 lift. This will allow the lifter to focus on particular elements
15 of the lift to eliminate potentially harmful poor technique.

16 One of the truly unique elements of the present invention,
17 however, is the bar position detector device which consists of two
18 interconnected elements, the cable angle detection devices **300a** and
19 **300b** and the bar position detection light curtains **350a** and **350b**,
20 each of which are connected in information transmission connection
21 with the computer-based control mechanism **112**, and which cooperate
22 to determine the position of the free weight support bar **72** at all
23 times during the lift. The cable angle detection devices **300a** and
24 **300b** are mounted on each weight support beam **20a** and **20b** and
25 positioned each adjacent the forward edge of one of the pulleys **82**
26 to detect the angles at which the cables **80a** and **80b** depend from
27 the weight support beams **20a** and **20b**. The angle combined with the
28 length of cable depending from the weight support beam **20a** and **20b**

1 will track the location of the free weight support bar **72** to permit
2 the user of the present invention to maintain a better lift track
3 during the lift thus reducing the chance of injury from improper
4 lifting.

5 The bar position detection light curtains **350a** and **350b** are
6 likewise mounted on the weight support beams **20a** and **20b** and extend
7 generally parallel therewith, the bar position detection light
8 curtains **350a** and **350b** operative to project a light/laser curtain
9 generally vertically downwards to a receiver bar **352a** and **352b**, one
10 mounted on each of the base feet **14a** and **14b**, such that any
11 interruption in the light curtain is noted by the computer-based
12 control mechanism **112** to which the bar position detection light
13 curtains **350a** and **350b** are connected in information transmission
14 connection. As the free weight support bar **72** is moved through the
15 bar position detection light curtains **350a** and **350b**, the horizontal
16 interruptions of the light curtain are recorded and the computer-
17 based control mechanism **112** or associated computer can calculate
18 and graph the path of the free weight support bar **72** during the
19 lift.

20 By combining the results from the cable angle detection device
21 **300** and the bar position detection light curtain **350a** and **350b**, the
22 track of the lift may be plotted and the user of the present
23 invention can obtain a visual representation of the lift. This
24 data can then be used by the lifter to remedy poor lifting
25 technique before the lifting technique can cause him or her injury.
26 This improvement is not found in the prior art and is a novel and
27 unique feature of the present invention.

28 It is to be understood that numerous additions, substitutions

1 and modifications may be made to the free weight assistance and
2 training device **10** which fall within the intended broad scope of
3 the above description. For example, the size, shape and
4 construction materials used in connection with the present
5 invention may be modified or changed so long as the intended
6 functionality of the invention is not degraded or destroyed.
7 Furthermore, the specific programming features of the present
8 invention may be modified or changed to permit the present
9 invention to be used with a variety of different exercise and
10 weightlifting programs. Finally, it should be noted that the
11 design features of the present invention are generally not critical
12 to the present invention so long as the intended functionality of
13 the invention is maintained.

14 There has therefore been shown and described an free weight
15 assistance and training device which accomplishes at least all of
16 its intended objectives.